

Application No.: 10/563,255
Art Unit: 3746

Amendment under 37 CFR §1.116
Attorney Docket No.: 053549

REMARKS

Please reconsider the application in view of the foregoing amendments and the following remarks.

Status of Claims

Claims 1-9 are pending in the present application. Claim 7 is withdrawn from consideration. Claims 1 and 8 are herein amended. No new matter has been entered.

Claim Rejections - 35 U.S.C. §103

As to the merits of this case, the Examiner sets forth the following rejections:

Claims 1, 4 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kuramoto (2004/0081565) in further view of Hall et al (6,708,981).

Claims 2, 8-9 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kuramoto/Hall as discussed above, in view of either Weatherston et al. (USP 3,667,874 hereinafter referred to as "Weatherston '874") or Weatherston (USP 3,922,117, hereinafter referred to as Weatherston '117").

Claims 3-4 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kuramoto/Hall as discussed above, in view of either Cringuette et al (4,887,941) or Morgan et al (4,850,806).

Claim 5 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kuramoto/Hall as discussed above, in view of either Baubron (4,442,353) or Becker (5,584,669).

Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kuramoto/Hall as discussed above, in view of Miura et al (6,056,510).

Applicants respectfully traverse these rejections because a *prima facie* case of obviousness has not been made.

The mere fact that references can be combined or modified does not render the resultant combination obvious **unless the results would have been predictable to one of ordinary skill in the art.** M.P.E.P. §2143.01(III).

Predictability as discussed in KSR encompasses the expectation that prior art elements are capable of being combined, **as well as the expectation that the combination would have worked for its intended purpose.** An inference that a claimed combination would not have been obvious is especially strong where the prior art's teachings undermine the very reason being

proffered as to why a person of ordinary skill would have combined the known elements. *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314 (Fed. Cir. 2009). (See also USPTO's Examination Guidelines Update: Developments in the Obviousness Inquiry after *KSR v. Teleflex*).

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). MPEP 2143.01(V).

If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). MPEP 2143.01(VI).

In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious (emphasis in original). MPEP 2141.02 (I).

Independent Claim 1

On page 5, item 14, the Examiner disagrees with the Applicants argument that Kuramoto teaches away from a potential multi-stage booster pump. The Examiner contends that even though Kuramoto doesn't teach a multi-stage booster pump, Kuramoto **does not specifically prohibit** multi-stage pumps to be used for the reasons he discusses on pages 2 and 3 of the instant Final Office Action.

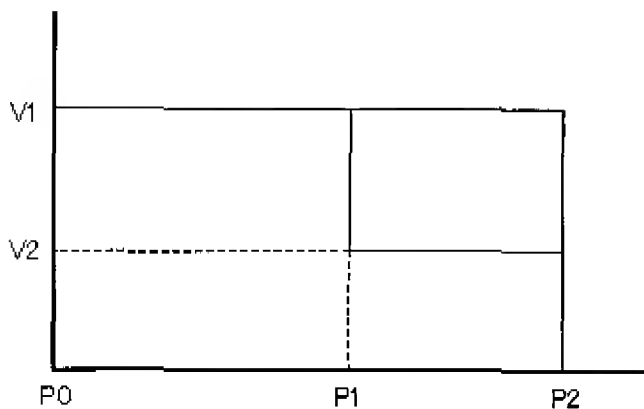
Applicants respectfully disagree with the Examiner. The test for obviousness is not conditioned upon the invention (Kuramoto) to **specifically prohibit** the combination as the Examiner proffers. Rather, the test is whether the resultant combination would have been **predictable** to one of ordinary skill in the art. See M.P.E.P. §2143.01(III). The "**predictable result**" under KSR requires that the combination work for **its intended purpose**. If proposed modification would render the prior art invention being modified **unsatisfactory for its intended purpose**, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

The **intended purpose** of Kuramoto is to prevent the temperature in the booster pump of the vacuum pump from becoming lower than the temperature in the main pump. This is because if the temperature in the booster pump of the vacuum pump becomes lower than the temperature

in the main pump, a reaction product is solidified and deposited in the booster pump which leads to a reduction in the performance of the vacuum pump ([0002])).

Kuramoto explicitly teaches using a single stage root pump as booster pump 61 and NOT a multi-stage booster pump. The reason being the multi-stage booster pump generates less heat as compared to a single stage booster pump. That is a multi-stage booster pump in place of single stage booster pump would destroy the feature of effectively raising the temperature in the booster pump which is described as an **“important point”** in Kuramoto ([0006])).

The following graph shows a difference in heat generation between a single-stage booster pump and a two-stage booster pump.



A quantity of heat generated in the single-stage booster pump Q1 is given by:

$$Q1 = V1 \times (P2 - P0),$$

where V1 is pumping speed (volume per unit time) of the single-stage booster pump, P0 is suction-side pressure of the booster pump, and P2 is suction-side pressure of a main pump.

On the other hand, a quantity of heat generated in the two-stage booster pump Q2 is given by:

$$Q2 = V1x(P1 - P0) + V2x(P2 - P1),$$

where V1 is pumping speed (volume per unit time) of a first-stage rotor of the two-stage booster pump, V2 is pumping speed of a second-stage rotor of the two-stage booster pump, P0 is suction-side pressure of the two-stage booster pump, P1 is discharge pressure of the first-stage rotor of the two-stage booster pump, and P2 is suction-side pressure of a main pump.

As can be seen from the above graph, Q2 is smaller than Q1 (i.e., $Q1 > Q2$). Consequently, using the two-stage booster pump instead of the single-stage booster pump will result in a lower temperature of the booster pump, thus causing the deposition of the reaction product.

The intended purpose of the present invention is to lower the temperature of the booster pump whose volume is becoming large as the size of a semiconductor wafer becomes large.

A booster pump having a lower pumping pressure is likely to lower the temperature thereof, thus causing deposition of the reaction product in the booster pump. Therefore, increasing the temperature of the booster pump will lead to a longer service life. Kuramoto discloses a method of increasing the temperature of the pump. In contrast, the present invention is intended to decrease the temperature of the pump. As a semiconductor wafer is becoming large in size, a larger booster pump is required for the evacuation of a large amount of process gasses. As a result a compression ratio of the booster pump to the main pump becomes large, causing the increase in the temperature of the booster pump, which would in turn cause problems for seals, bearing, and the like. Thus, in order to maintain reliability of the seals and bearings, the present invention provides a multistage booster pump that can reduce the temperature thereof.

The Kuramoto reference teaches the method of increasing the temperature of the booster pump having a single-stage rotor. This is different from the present invention.

Hall teaches use of a two-stage booster pump as indicated by the Examiner. However, Hall does not teach or suggest "a booster pump having a pair of multistage Roots-type pump rotors comprising an inlet-side rotor and an outlet-side rotor, an axial width of said inlet-side rotor being larger than an axial width of said outlet-side rotor."

Firstly, Hall does not teach a booster pump having a pair of multistage Roots-type pump rotors. Instead, Hall discloses a booster pump in which a *piston* is driven by either compressed nitrogen, air or pumped fluid from a source. Sec column 3, lines 51 to 53.

Secondly, Hall does not teach that the axial width of the inlet-side rotor is larger than the axial width of the outlet-side rotor. This configuration can reduce a load on the pump and motor and can therefore reduce the rise in temperature due to the compression of gas.

In view of the foregoing, it is our belief that Kuramoto teaches away and this teaching away would have deterred a person of ordinary skill from combining the references in the manner proposed by the Examiner.

Therefore, Applicants respectfully submit that claims 1-6 and 8-9 are not obvious.

Conclusion

The Claims have been shown to be allowable over the prior art. Applicants believe that this paper is responsive to each and every ground of rejection cited in the Office Action dated April 14, 2011, and respectfully request favorable action in this application. The Examiner is invited to telephone the undersigned, applicants' attorney of record, to facilitate advancement of the present application.

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If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,
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